REMARKS

Claims 1-57 remain present in this application.

Claim 1 has been amended. Reconsideration of the application, as amended, is respectfully requested.

Withdrawal of Restriction Requirement

Applicants gratefully acknowledge that the Examiner has withdrawn the previous Restriction Requirement.

Amendments to the Claims

Independent claim 1 has been amended to recite providing a first layer having a first silicon material; performing a hydrogen treatment on the first layer to form a **hydrogenated** surface thereon; and forming a second layer having a second silicon material on the **hydrogenated** surface of the first layer. Referring to Figs. 2C-2F, the disclosed technology can thus securely deposit the upper sacrificial silicon layer (250) on the lower sacrificial silicon layer (210) without peeling.

Support for the limitation in claim 1 can be found in Figs. 2A-2F and in the embodiments.

Rejection under 35 USC 103

Claims 1-57 stand rejected under 35 USC 103 as being unpatentable over HUIBERS et al., U.S. Patent 6,741,383, in view of

CHINN et al., U.S. Publication 2004/0033639 A1. This rejection is respectfully traversed.

Independent Claim 1

With regard to HUIBERS et al., the Examiner's attention is drawn to Figs. 4, and 5A-5C. HUIBERS et al. discloses deflectable micromirrors with stopping mechanisms. A first sacrificial silicon layer 512 is deposited on a transmissive substrate 511. A mirror plate 513 is patterned on part of the first sacrificial silicon layer 512. A second sacrificial layer 514 is deposited over the first sacrificial silicon layer 512 and the mirror plate 513. A mirror support structure 515 is defined to connect to the mirror plate 513 and the substrate 511. The first and second sacrificial silicon layers 512 and 514 are removed to release the mirror plate 513. It is noted that, before formation of the second sacrificial layer 514, there is **no** hydrogen treatment performing on the first sacrificial layer 512, **unlike** claim 1 which contemplate performing a **hydrogen** treatment on the first layer to form a **hydrogenated** surface thereon and forming a second layer having a second silicon material on the hydrogenated surface of the first layer. That is, HUIBERS et al. has no reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers.

HUIBERS et al. does not anticipate independent claim 1 because it does not teach or suggest providing a first layer having a first silicon material; performing a hydrogen treatment on the first layer to form a hydrogenated surface thereon; and forming a second layer having a second silicon material on the hydrogenated surface of the first layer. As a result, the methods according to independent claim 1 of the present application and HUIBERS et al. are different.

With regard to CHINN et al., the Examiner's attention is drawn to Figs. 1A-1C, 2B-2C and 7, paragraph [0099], and claim 1. CHINN et al. discloses a method of preventing stiction in a released MEMS structure (as shown in Fig. 1C). An oxygen-containing plasma treatment 720 is performed on the surface of a MEMS structure. A release process 730 is then performed to remove sacrificial materials 104 and free moving MEMS elements 107. **After removing sacrificial materials**, a surface **oxidation and hydrogen** treatment 740 is performed to create the released MEMS structure with a **hydroxylated** surface 220, as shown in Fig. 2B. A self-assembled monolayer (SAM) coating 770 is performed on the hydroxylated surface 220 to create a MEMS surface 230 with a SAM, as shown in Fig. 2C. The cited reference can thus improve the adhesion between the SAM and the MEMS surface, preventing stiction. <u>It is noted that the cited reference creates the **released** MEMS structure with a **hydroxylated** surface 220, **unlike** claim 1 which contemplate</u>

performing a hydrogen treatment on the first layer to form a **hydrogenated** surface thereon and forming a second layer having a second silicon material on the hydrogenated surface of the first layer. In addition, since the bonded hydroxyl groups of the cited reference include **oxygen**, the oxygen may cause peeling between sacrificial silicon layers in the MEMS process. That is, CHINN et al. has **no** reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers.

CHINN et al. does not anticipate **claim 1** because it does not teach or suggest providing a first layer having a first silicon material; performing a hydrogen treatment on the first layer to form a hydrogenated surface thereon; and forming a second layer having a second silicon material on the hydrogenated surface of the first layer. As a result, the methods according to independent claim 1 of the present application and CHINN et al. are different.

For the reasons mentioned above, the prior art cannot make the independent claim 1 obvious under 35 U.S.C 103, as there is no suggestion of providing a first layer having a first silicon material; performing a **hydrogen** treatment on the first layer to form a **hydrogenated** surface thereon; and forming a second layer having a second silicon material on the hydrogenated surface of the first layer.

As neither HUIBERS et al. nor CHINN et al. teach or suggest all the limitations of independent claim 1, it is respectfully

submitted that independent claim 1, as well as its dependent claims 2-9, are allowable over the prior art utilized by the Examiner.

Independent Claim 10

The Examiner's attention is drawn to Figs. 4, and 5A-5C of HUIBERS et al. HUIBERS et al. discloses deflectable micromirrors with stopping mechanisms. A first sacrificial silicon layer 512 is deposited on a transmissive substrate 511. A mirror plate 513 is patterned on part of the first sacrificial silicon layer 512. A second sacrificial layer 514 is deposited over the first sacrificial silicon layer 512 and the mirror plate 513. A mirror support structure 515 is defined to connect to the mirror plate 513 and the substrate 511. The first and second sacrificial silicon layers 512 and 514 are removed to release the mirror plate 513. It is noted that, before formation of the second sacrificial layer 514, there is **no** hydrogen treatment performing on the first sacrificial layer 512, **unlike** claim 10 which contemplate performing a **hydrogen** treatment on the first layer to form an **H-treated silicon surface with Si-H bonds** thereon and forming a second layer having a second silicon material on the H-treated silicon surface. That is, HUIBERS et al. has no reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers.

HUIBERS et al. does not anticipate **claim 10** because it does not teach or suggest providing a first layer having a first silicon material; performing a hydrogen treatment on the first layer to form an H-treated silicon surface with Si-H bonds thereon; and forming a second layer having a second silicon material on the H-treated silicon surface. As a result, the methods of independent claim 10 and HUIBERS et al. are different.

The Examiner's attention is drawn to Figs. 1A-1C, 2B-2C and 7, paragraph [0099], and claim 1 of CHINN et al. CHINN et al. discloses a method of preventing stiction in a released MEMS structure (as shown in Fig. 1C). An oxygen-containing plasma treatment 720 is performed on the surface of a MEMS structure. A release process 730 is then performed to remove sacrificial materials 104 and free moving MEMS elements 107. **After removing sacrificial materials**, a surface **oxidation and hydrogen** treatment 740 is performed to create the released MEMS structure with a **hydroxylated** surface 220, as shown in Fig. 2B. A self-assembled monolayer (SAM) coating 770 is performed on the hydroxylated surface 220 to create a MEMS surface 230 with a SAM, as shown in Fig. 2C. The cited reference can thus improve the adhesion between the SAM and the MEMS surface, preventing stiction. <u>It is noted that the cited reference creates the **released** MEMS structure with a **hydroxylated** surface 220, **unlike** claim 10 which contemplate performing a **hydrogen** treatment on the first layer to form an **H-**</u>

treated silicon surface with Si-H bonds thereon and forming a second layer having a second silicon material on the H-treated silicon surface. In addition, since the bonded hydroxyl groups of the cited reference include **oxygen,** the oxygen may cause peeling between sacrificial silicon layers in the MEMS process. Contrarily, the **Si-H bonds** of the invention can be replaced with strong covalent **Si-Si bonds** during deposition of the upper sacrificial silicon layer without peeling. That is, CHINN et al. has **no** reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers.

CHINN et al. does not anticipate **claim 10** because it does not teach or suggest providing a first layer having a first silicon material; performing a hydrogen treatment on the first layer to form an H-treated silicon surface with Si-H bonds thereon; and forming a second layer having a second silicon material on the H-treated silicon surface. As a result, the methods of independent claim 10 and CHINN et al. are different.

For the reasons mentioned above, the prior art cannot make independent claim 10 obvious under 35 U.S.C 103, as there is no suggestion of providing a first layer having a first silicon material; performing a **hydrogen** treatment on the first layer to form an **H-treated silicon surface with Si-H bonds** thereon; and forming a second layer having a second silicon material on the H-treated silicon surface.

As neither HUIBERS et al. nor CHINN et al. teach or suggest all the limitations recited in independent claim 10, it is respectfully submitted that independent claim 10, as well as its dependent claims 11-19, are allowable over the prior art utilized by the Examiner.

Independent Claim 20

The Examiner's attention is drawn to Figs. 4, and 5A-5C of HUIBERS et al. HUIBERS et al. discloses deflectable micromirrors with stopping mechanisms. A first sacrificial silicon layer 512 is deposited on a transmissive substrate 511. A mirror plate 513 is patterned on part of the first sacrificial silicon layer 512. A second sacrificial layer 514 is deposited over the first sacrificial silicon layer 512 and the mirror plate 513. A mirror support structure 515 is defined to connect to the mirror plate 513 and the substrate 511. The first and second sacrificial silicon layers 512 and 514 are removed to release the mirror plate 513. It is noted that, the first sacrificial silicon layer 512 has **no** H-treated surface, **unlike** claim 20 which contemplate providing at least one micromechanical structural layer above a substrate, the micromechanical structural layer being sustained between a lower sacrificial silicon layer having an **H-treated surface** and an upper sacrificial silicon layer; and removing the upper and lower sacrificial silicon layers; wherein the **H-treated silicon surface**

<u>increases interface adhesion between the lower and upper sacrificial silicon layers.</u> That is, HUIBERS et al. has no reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers.

HUIBERS et al. does not anticipate independent claim 20 because it does not teach or suggest providing at least one micromechanical structural layer above a substrate, the micromechanical structural layer being sustained between a lower sacrificial silicon layer having an H-treated surface and an upper sacrificial silicon layer; and removing the upper and lower sacrificial silicon layers; wherein the H-treated silicon surface increases interface adhesion between the lower and upper sacrificial silicon layers. As a result, the methods of independent claim 20 and HUIBERS et al. are different.

The Examiner's attention is drawn to Figs. 1A-1C, 2B-2C and 7, paragraph [0099], and claim 1 of CHINN et al. CHINN et al. discloses a method of preventing stiction in a released MEMS structure (as shown in Fig. 1C). An oxygen-containing plasma treatment 720 is performed on the surface of a MEMS structure. A release process 730 is then performed to remove sacrificial materials 104 and free moving MEMS elements 107. **After removing sacrificial materials**, a surface **oxidation and hydrogen** treatment 740 is performed to create the released MEMS structure with a **hydroxylated** surface 220, as shown in Fig. 2B. A self-assembled

monolayer (SAM) coating 770 is performed on the hydroxylated surface 220 to create a MEMS surface 230 with a SAM, as shown in Fig. 2C. The cited reference can thus improve the adhesion between the SAM and the MEMS surface, preventing stiction. It is noted that the cited reference creates the **released** MEMS structure with a **hydroxylated** surface 220 **after removing sacrificial materials, unlike** claim 20 which contemplate the micromechanical structural layer being sustained between **a lower sacrificial silicon layer having an H-treated surface** and an upper sacrificial silicon layer; and removing the upper and lower sacrificial silicon layers; wherein the **H-treated silicon surface** increases interface adhesion between the lower and upper sacrificial silicon layers. In addition, since the bonded hydroxyl groups of the cited reference include **oxygen,** the oxygen may cause peeling between sacrificial silicon layers in the MEMS process. That is, CHINN et al. has no reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers.

CHINN et al. does not anticipate independent claim 20 because it does not teach or suggest providing at least one micromechanical structural layer above a substrate, the micromechanical structural layer being sustained between a lower sacrificial silicon layer having an H-treated surface and an upper sacrificial silicon layer; and removing the upper and lower sacrificial silicon layers; wherein the H-treated silicon surface increases interface adhesion

between the lower and upper sacrificial silicon layers. As a result, the methods of independent claim 20 and CHINN et al. are different.

For the reasons mentioned above, the prior art cannot make the independent claim 20 obvious under 35 U.S.C 103, as there is no suggestion of providing at least one micromechanical structural layer above a substrate, the micromechanical structural layer being sustained between a lower sacrificial silicon layer having an **H-treated surface** and an upper sacrificial silicon layer; and removing the upper and lower sacrificial silicon layers; wherein the H-treated silicon surface increases interface adhesion between the lower and upper sacrificial silicon layers.

As neither HUIBERS et al. nor CHINN et al. teach or suggest all the limitations recited in claim 20, it is respectfully submitted that independent claim 20 and its dependent claims 21-29 are allowable over the prior art utilized by the Examiner.

Independent Claims 30 and 44

The Examiner's attention is drawn to Figs. 4, and 5A-5C of HUIBERS et al. HUIBERS et al. discloses deflectable micromirrors with stopping mechanisms. A first sacrificial silicon layer 512 is deposited on a transmissive substrate 511. A mirror plate 513 is patterned on part of the first sacrificial silicon layer 512. A second sacrificial layer 514 is deposited over the first

sacrificial silicon layer 512 and the mirror plate 513. A mirror support structure 515 is defined to connect to the mirror plate 513 and the substrate 511. The first and second sacrificial silicon layers 512 and 514 are removed to release the mirror plate 513. It is noted that, before formation of the second sacrificial layer 514, there is **no** hydrogen treatment performing on the first sacrificial layer 512, **unlike** claims 30 and 44 which contemplate performing a **hydrogen** treatment on the first sacrificial silicon layer to form an **H-treated silicon surface** thereon and forming a second sacrificial silicon layer over the first sacrificial silicon layer. That is, HUIBERS et al. has no reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers.

HUIBERS et al. does not anticipate independent claims 30 and 44 because it does not teach or suggest performing a hydrogen treatment on the first sacrificial silicon layer to form an H-treated silicon surface thereon and forming a second sacrificial silicon layer over the first sacrificial silicon layer. That is, the cited reference has no reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers. As a result, the methods of independent claims 30 and 44 and HUIBERS et al. are different.

The Examiner's attention is drawn to Figs. 1A-1C, 2B-2C and 7, paragraph [0099] and claim 1 of CHINN et al. CHINN et al.

discloses a method of preventing stiction in a released MEMS structure (as shown in Fig. 1C). An oxygen-containing plasma treatment 720 is performed on the surface of a MEMS structure. A release process 730 is then performed to remove sacrificial materials 104 and free moving MEMS elements 107. **After removing sacrificial materials**, a surface **oxidation and hydrogen** treatment 740 is performed to create the released MEMS structure with a **hydroxylated** surface 220, as shown in Fig. 2B. A self-assembled monolayer (SAM) coating 770 is performed on the hydroxylated surface 220 to create a MEMS surface 230 with a SAM, as shown in Fig. 2C. The cited reference can thus improve the adhesion between the SAM and the MEMS surface, preventing stiction. <u>It is noted that the cited reference creates the **released** MEMS structure with a **hydroxylated** surface 220 **after removing sacrificial materials, unlike** claims 30 and 44 which contemplate performing a **hydrogen** treatment on the first sacrificial silicon layer to form an **H-treated silicon surface** thereon and forming a second sacrificial silicon layer over the first sacrificial silicon layer.</u> <u>In addition, since the bonded hydroxyl groups of the cited reference include **oxygen,** the oxygen may cause peeling between sacrificial silicon layers in the MEMS process.</u> That is, CHINN et al. has no reasonable expectation of success for achieving a method of preventing peeling between sacrificial silicon layers.

CHINN et al. does not anticipate independent claims 30 and 44 because it does not teach or suggest performing a hydrogen treatment on the first sacrificial silicon layer to form an H-treated silicon surface thereon and forming a second sacrificial silicon layer over the first sacrificial silicon layer. As a result, the method according to claims 30 and 44 and the cited reference is different.

For the reasons mentioned above, the prior art cannot make independent claims 30 and 44 obvious under 35 U.S.C 103, as there is no suggestion of performing a **hydrogen** treatment on the first sacrificial silicon layer to form an **H-treated silicon surface** thereon and forming a second sacrificial silicon layer over the first sacrificial silicon layer.

As neither HUIBERS et al. nor CHINN et al. teach or suggest all the limitations recited in independent claims 30 and 44, it is respectfully submitted that independent claims 30 and 44, as well as their dependent claims 31-43 and 45-57, respectively, are allowable over the prior art utilized by the Examiner.

In MPEP 2142, the Examiner is reminded that to establish a prima facie case of obviousness, three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teaching. Second, there must be a reasonable

expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. It is respectfully submitted that the Examiner has failed to satisfy these criteria in asserting that the rejected claims are obvious in view of CHINN et al. combined with HUIBERS et al.

In view of the foregoing amendments and remarks, it is respectfully submitted that the methods of the present application are neither taught nor suggested by the prior art utilized by the Examiner. Accordingly, reconsideration and withdrawal of the 35 USC 103 rejection are respectfully requested.

Conclusion

Favorable reconsideration and an early Notice of Allowance are earnestly solicited.

Because the additional prior art cited by the Examiner has been included merely to show the state of the prior art and has not been utilized to reject the claims, no further comments concerning these documents are considered necessary at this time.

In the event that any outstanding matters remain in this application, the Examiner is invited to contact the undersigned at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachments: Replacement Drawing Sheet

AMENDMENTS TO THE DRAWINGS

Attached hereto is one (1) sheet of corrected drawings that comply with the provisions of 37 C.F.R. § 1.84. The corrected drawings incorporate the following drawing changes:

In Figs. 1A and 1B, the label "RELATED ART" has been added.

It is respectfully requested that the corrected drawings be approved and made a part of the record of the above-identified application.